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the zones, or under different types of climate, our author takes it up under indoor life, outdoor life, and race and nationality. Most of the illustrations of climatic control are very familiar, and we cannot help feeling that several of them are far-fetched. For example (p. 113), in speaking of an Alpine valley which opens towards the north, the author says that it "is entirely cut off from the direct rays of the sun, with the consequence that a hideous disease called cretinism lurks among its inhabitants." We have never heard that cretinism was due to lack of sunshine. In his consideration of the influence of climate upon the color of the skin, and upon other physical and mental characteristics, our author touches upon many matters of active controversy with a very strong leaning on his part in favor of the climatic control. Curiously placed, at the end of the book, comes a chapter on meteorology, which seems to us quite out of place there. We feel sure that Mr. Bonacina's little volume will find a good number of readers, and that it will do its work well in directing attention, in an interesting way, to the importance of our climatic environment.

R. DeC. Ward.

PHYSICAL GEOGRAPHY

Physik der Erde. Von Prof. M. P. Rudzki. viii and 584 pp. 60 text figures and 5 plates. Chr. Herm. Tauchnitz, Leipzig, 1911. M. 14. 9½ x 6.

Students of geophysics will welcome this comprehensive work, which presents the results of the physical and mathematical studies of earth problems, and in a form, as far as possible, intelligible to the non-mathematical though scientific reader. In a good many chapters a knowledge of the differential and integral calculus is indeed assumed, but Prof. Rudzki shows an exceptional facility in stripping his subject of non-essentials and so laying the outlines clearly before the reader. Excepting only the subjects of earth magnetism and meteorology, the attempt has been made to cover the entire field of earth physics.

The author of this comprehensive work is Director of the Astronomical Observatory at Cracow and holds the unusual title of Professor of Physical Geography and Astronomy in the University at that place. The book is the author's German translation of his own work originally published in Polish two years earlier.

The figure of the earth he treats at considerable length in three chapters (100 pages) which are admirably clear summaries of the various calculations upon the form of the geoid, based upon gravity and geodetic measurements. It is a little remarkable that no mention should be made of the earth's departure from the spheroidal toward the modified tetrahedral figure, as clearly indicated by the distribution of ocean and continent, the disposition of ancient land masses, etc. In discussing the rigidity of the planet, though the tidal argument is given with much fullness, that based upon earthquake waves, and Kelvin's argument from continued rotation are not taken up.

The rôle of radium in modifying the effect of secular cooling Rudzki believes to be so great as probably to mask completely the loss of heat from radiation, though admitting that the time has not yet come for a definite pronouncement. He thus places himself upon the side of Joly and as against the views of Strutt that only the earth's shell to a depth of about 72 kilometers contains radium.

The appearance of this work of a mathematician with a more or less general assumption of authority, makes it pertinent to comment upon the manner in which its conclusions should be received. The name "exact sciences" as applied to those which make use of the mathematical method, is with little doubt responsible for some misconception concerning the degree of confidence which should be reposed in conclusions within their field; for though the methods may be exact and unimpeachable, it has been notably true that mathematical investigations in the field of earth science have been based upon assumptions that are often largely gratuitous. In part this has been explained by the large scales employed, but very largely it is accounted for by the fact that the worker is far removed from the observational method which in other fields has become the dominant note of modern science. It is not so long since Lord Kelvin, with perhaps a pardonable arrogance, assured the geologist that exact mathematical calculations based upon the rate of secular cooling of the earth had made the geologists' assumptions concerning the length of geological time quite absurd. At the recent Winnipeg meeting of the British Association Sir J. J. Thomson, who had still further reduced the geologists' allowance of time, admitted in his Presidential address for the fraternity of the mathematicians that Kelvin's assertion must now be withdrawn.

To-day a new and equally insistent demand has been made by the mathematician upon the basis of extended geodetic observations interpreted to prove that the earth's outer shell is perfectly plastic and in complete adjustment above a quite definite spherical surface of compensation. This claim of Hayford, when modified by other assumptions suggested by Chamberlin, doubled the depth of the surface of compensation, and it has recently been shown by Lewis that Hayford's values depend upon a quite unwarranted assumption that within the outer shell of the earth compensation is complete. Hayford's studies in large part, and those of Hecker which have been interpreted to confirm them, do not deal directly with variations in the value of gravity, but with deflections of the vertical only. The haste with which some geologists have accepted these conclusions, suggests that more attention has been fixed upon the number and the precision of the measurements than upon the somewhat sweeping assumptions that have been coupled with them. It is because Prof. Rudzki has quoted these results with so much approval, and because Lewis's paper had not appeared at the time the "Physik der Erde" was published that these comments are necessary.

Discussing isostasy in especial relation to areas of erosion and deposition with use of Airy's assumptions, Rudzki concludes that if earth density increases with depth, isostatic sinking within areas of deposition, and elevation within areas of denudation, must come to an end. Thus despite isostatic stress an eroded upland should be reduced to a plain.

Upon the assumption that the amount of water upon the globe has remained constant, and using figures from the measure of the post-Pleistocene elevation of northern glaciated areas in connection with those for the dimensions of existing Arctic glaciers, it is derived that the maximum local thickness of the Pleistocene continental glaciers was about 1667 meters.

Professor Rudzki's application of mechanics to the problems of Alpine folding and especially to the hypothesized *nappes de charriage* will be read with especial interest, since it had before been claimed that these ingenious explanations of the observed conditions are mechanically impossible. Willis's recent discovery of a simple and more rational explanation in two systems of thrusts which have come from opposite quarters, will tend to emphasize the already existing doubt concerning the Swiss structures, which doubt Rudzki echoes.

A few only of the subjects treated in Professor Rudzki's book can be referred to in a review like the present. As a work of reference and as a guide to the literature of the subject, it will be especially useful to geologists, and it is a volume of which account must be taken by all who are interested in those ultimate causes of earth changes which lie hidden behind the observed phenomena.

William Herbert Hobbs.

Aeronautische Meteorologie. Von Dr. Franz Linke. I. Teil: viii and 133 pp. Mit 43 Textabbildungen und 8 Tabellen. M. 3. II. Teil: viii and 126 pp. Mit 37 Textabbildungen und 7 farbigen Tafeln. M. 3,50. Verlag von Franz Benjamin Auffarth, Frankfurt a.M., 1911. 9½ x 6 each.

These volumes were written as a meteorological text book for air navigators whether traveling by free balloon or one of the various types of dirigibles. The important influence of the air conditions upon such flights created a demand for an explanatory work dealing, as simply as possible, with the science of meteorology and the instruments and methods used in observational work, with a special view to the needs of air travelers. The work has already been highly approved in Germany for its practicability in the hands of aeronauts.

MATHEMATICAL GEOGRAPHY

Hydrographic Surveying: Elementary. For Beginners, Seamen and Others. By Commander Stuart. V.S.C. Messum. xiv and 504 pp. Maps, illustrations, appendices and index. Charles Griffin & Co., Ltd., 1910. $3.75. 8 x 5½.

In the preface the author says that this book is intended as a guide to all those whose duty it is intelligently and correctly to report to the proper authorities the changes that are occurring in the harbors and rivers and to those who wish to carry out some original work. Part I describes the instruments used for the work, and, in this section, the book does not differ materially from other books on surveying. Part II has three brief chapters and discusses the essential and usual appurtenances of a map. This includes the description of two projections, the gnomonic and the Mercator, scale and legend. This is the weakest portion of the book, partly from the manner of presentation and partly because the application of the material, which is limited wholly to the needs of the work, is not evident at this point. The third part is headed Practical Construction and is the main portion of the text. Here is described the process of surveying by triangulation, the fixing of the coast line, the surveying of a river-mouth, sounding and locating shoals. This is illustrated by many examples and a number of plates are inserted to show the different stages of the work. An extensive list of appendices furnish additional information for the student. The book is intended for beginners but the text matter pre-supposes a knowledge of plane and spherical trigonometry. R. M. Brown.

GENERAL

The Periplus of the Erythraean Sea. Travel and Trade in the Indian Ocean, by a Merchant of the First Century. Translated from the Greek and Annotated by Wilfred H. Schoff, A.M., Secretary of the Commercial Museum, Philadelphia. 323 pp. Maps, ills. and index. Longmans, Green & Co., New York, 1912. $2. 6 x 9½.

In the "Foreword" with which Dr. W. P. Wilson introduces Mr. Schoff's